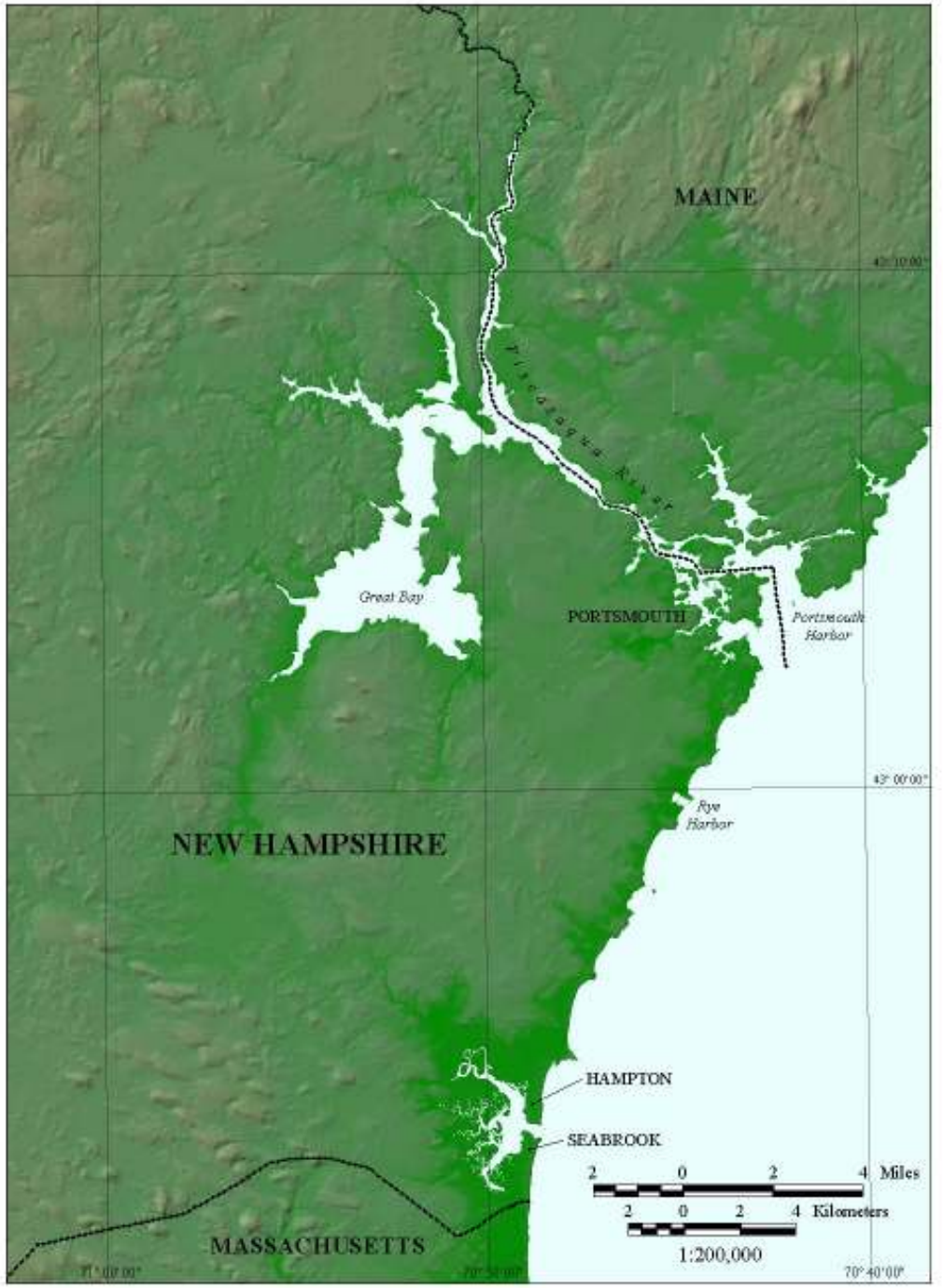


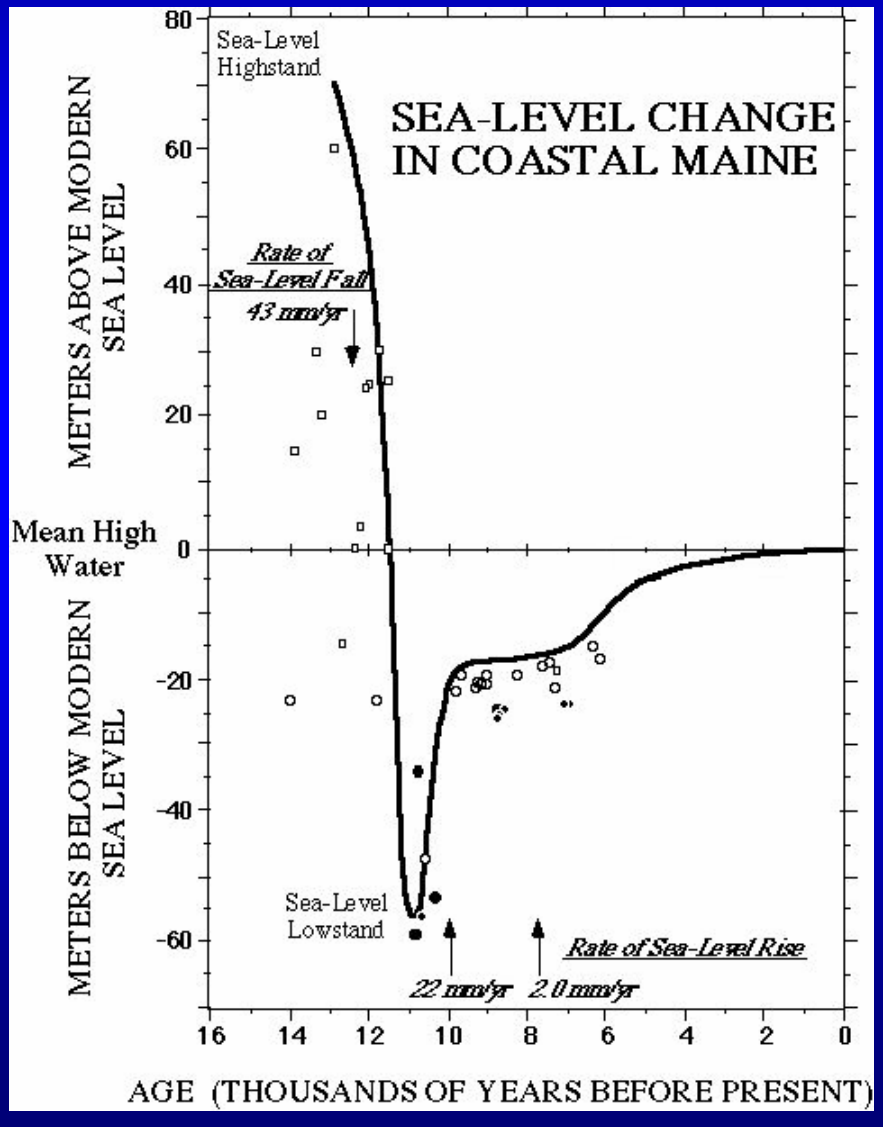
Great Bay Estuary, New Hampshire

- *Origin of Estuary*
  - *Sea-level Changes*
- *Physical Characteristics*
  - *Lower*
  - *Upper*
- *Sources of Sediments*
- *Biologic-Sedimentologic Interactions*

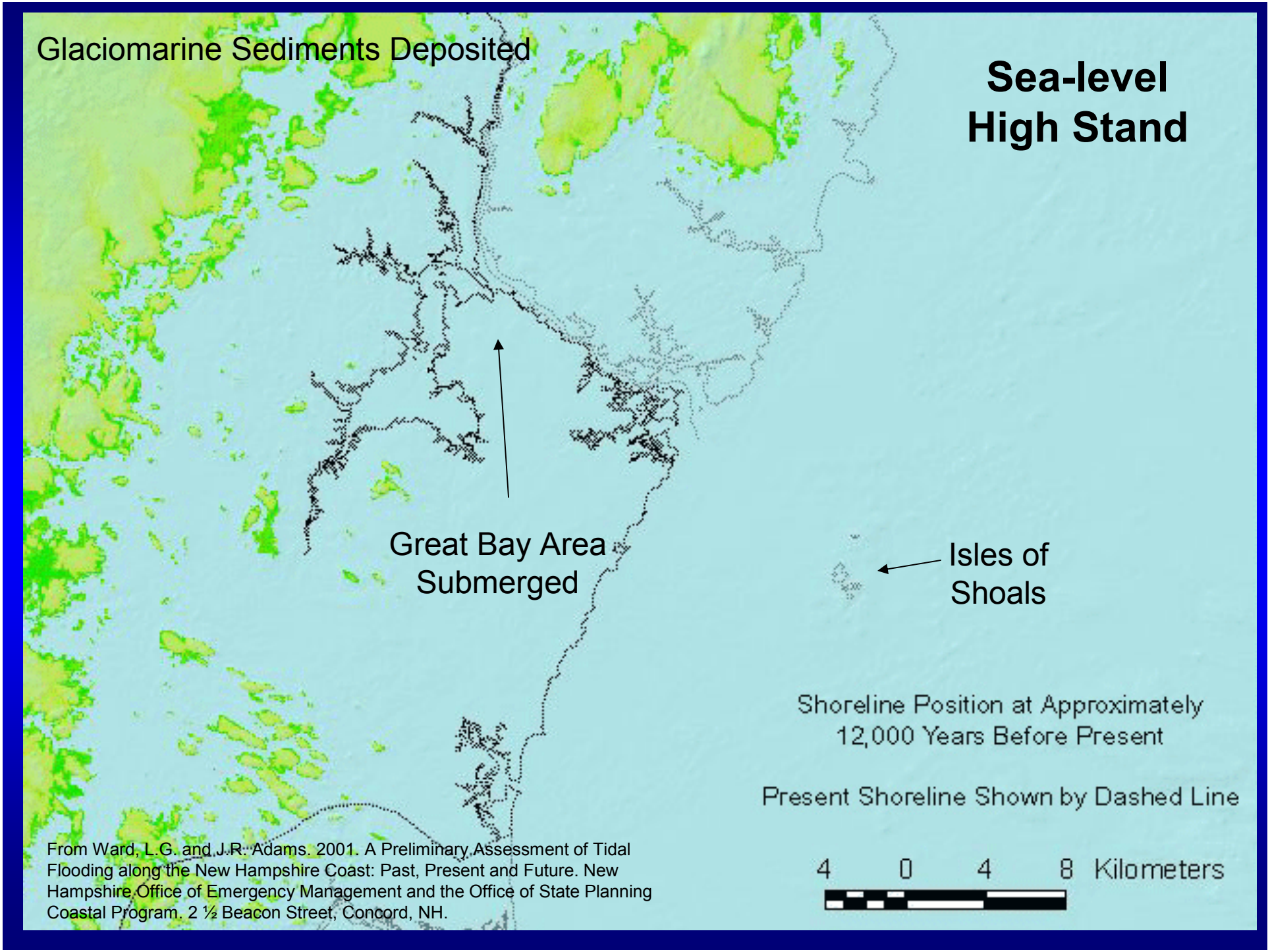
Origin of Great Bay Estuary

(Drowned River Estuary)

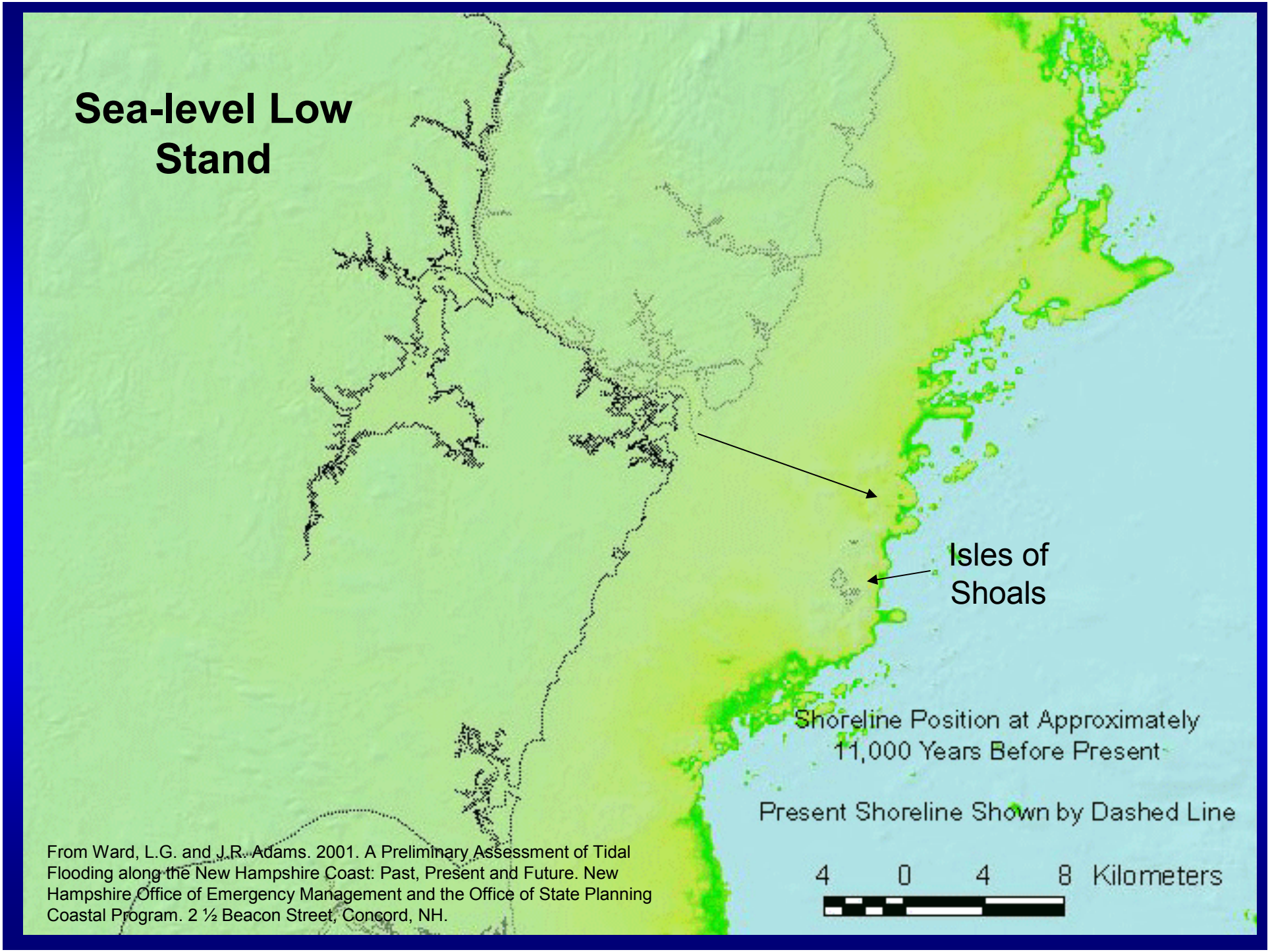
- *Formed from Flooding of River Valley*
- *During Lower Sea-Level Piscataqua River Flowed Through River Valley*
- *Sea-Level Rise Flooded Valley and Formed Great Bay Estuary*



Sea-level Curve from Maine Geological Survey Web Site (Kelley, Dickson, and Belknap; http://www.maine.gov/doc/nrimc/mgs/explore/marine/facts/sealevel.htm)



From Ward, L.G. and J.R. Adams. 2001. A Preliminary Assessment of Tidal Flooding along the New Hampshire Coast: Past, Present and Future. New Hampshire Office of Emergency Management and the Office of State Planning Coastal Program. 2 ½ Beacon Street, Concord, NH.



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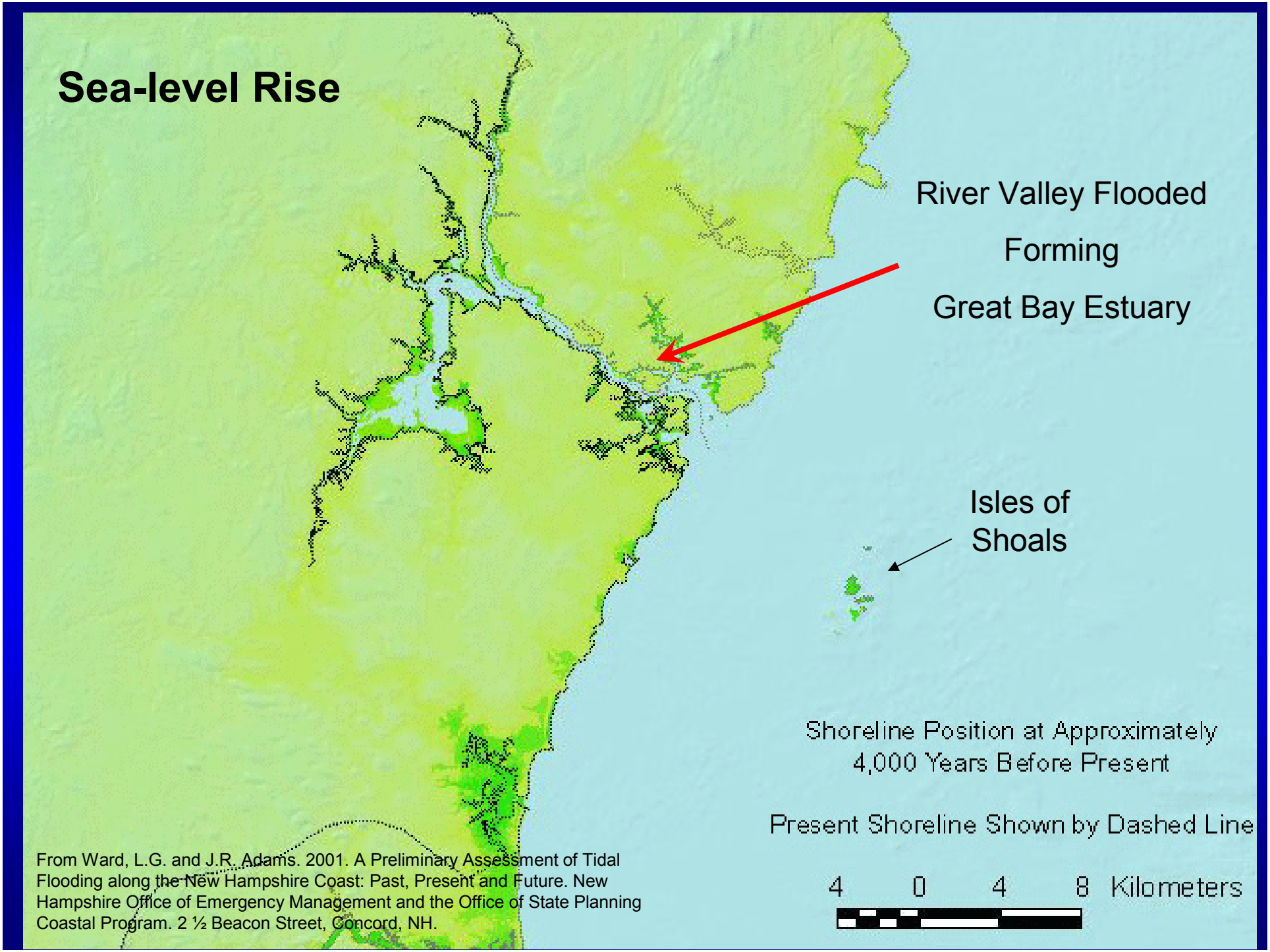
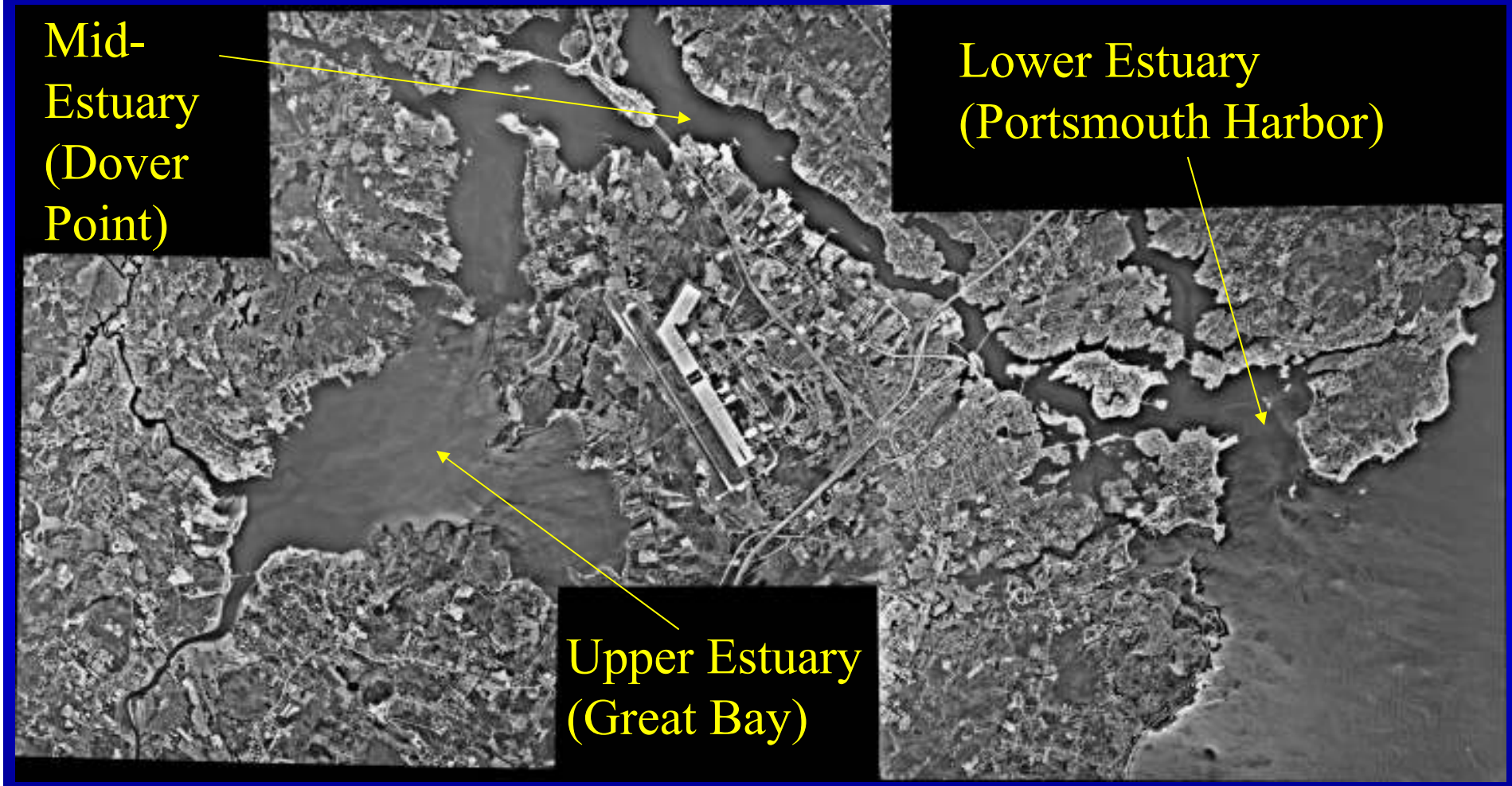

Sea-level Rise
River Valley Flooded
Forming
Great Bay Estuary
Isles of
Shoals
Shoreline Position at Approximately
4,000 Years Before Present
Present Shoreline Shown by Dashed Line
4 0 4 8 Kilometers
From Ward, L.G. and J.R. Adams. 2001. A Preliminary Assessment of Tidal Flooding along the New Hampshire Coast: Past, Present and Future. New Hampshire Office of Emergency Management and the Office of State Planning Coastal Program. 2 ½ Beacon Street, Concord, NH.

Characteristics of the Lower Great Bay Estuary

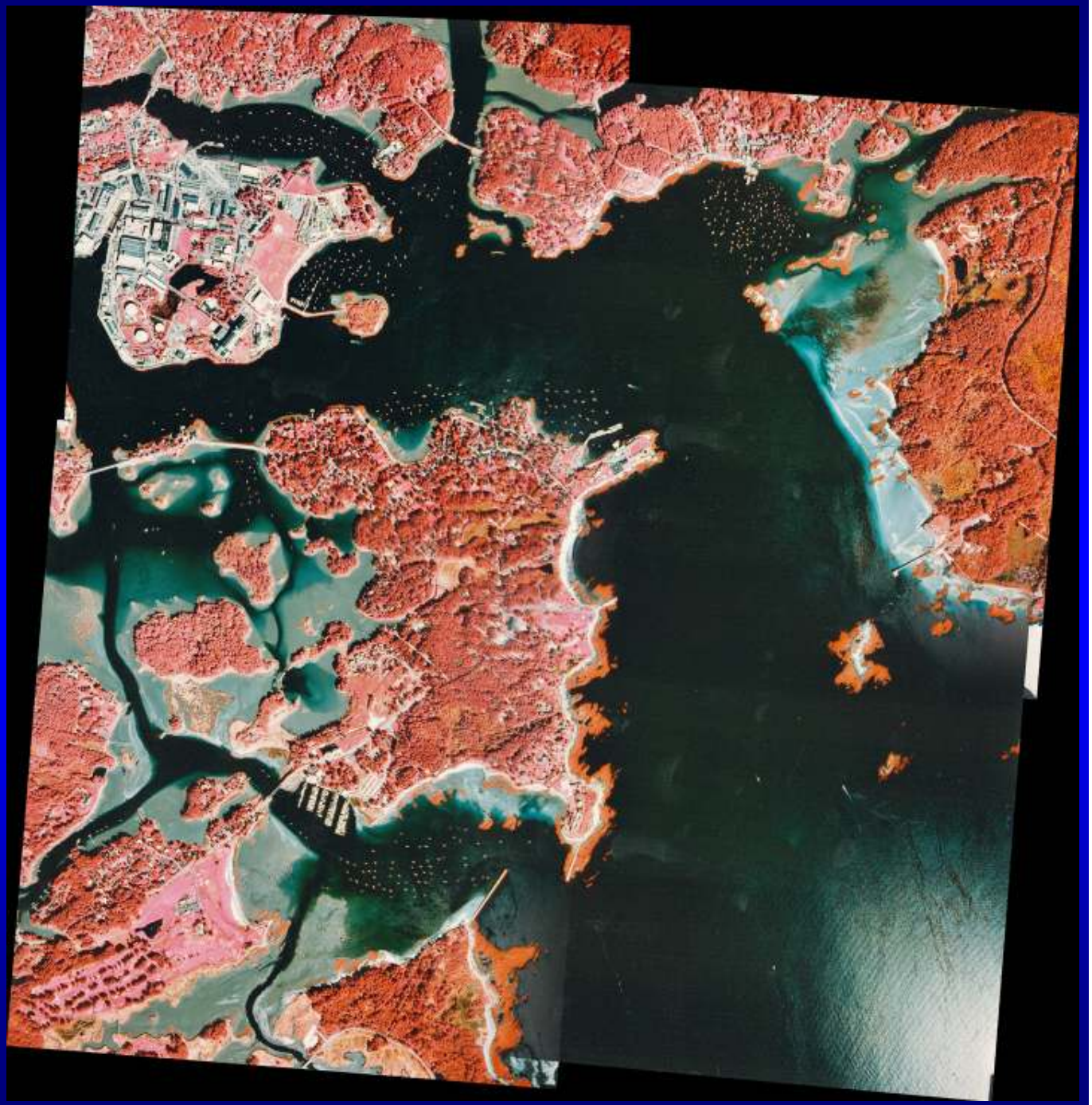


Location Bedrock Controlled

Steep Gradients (Limited Accommodation Space)

Strong Tidal Currents (Mesotidal)

Limited Sediment Supply



Physical Characteristics of Portsmouth Harbor

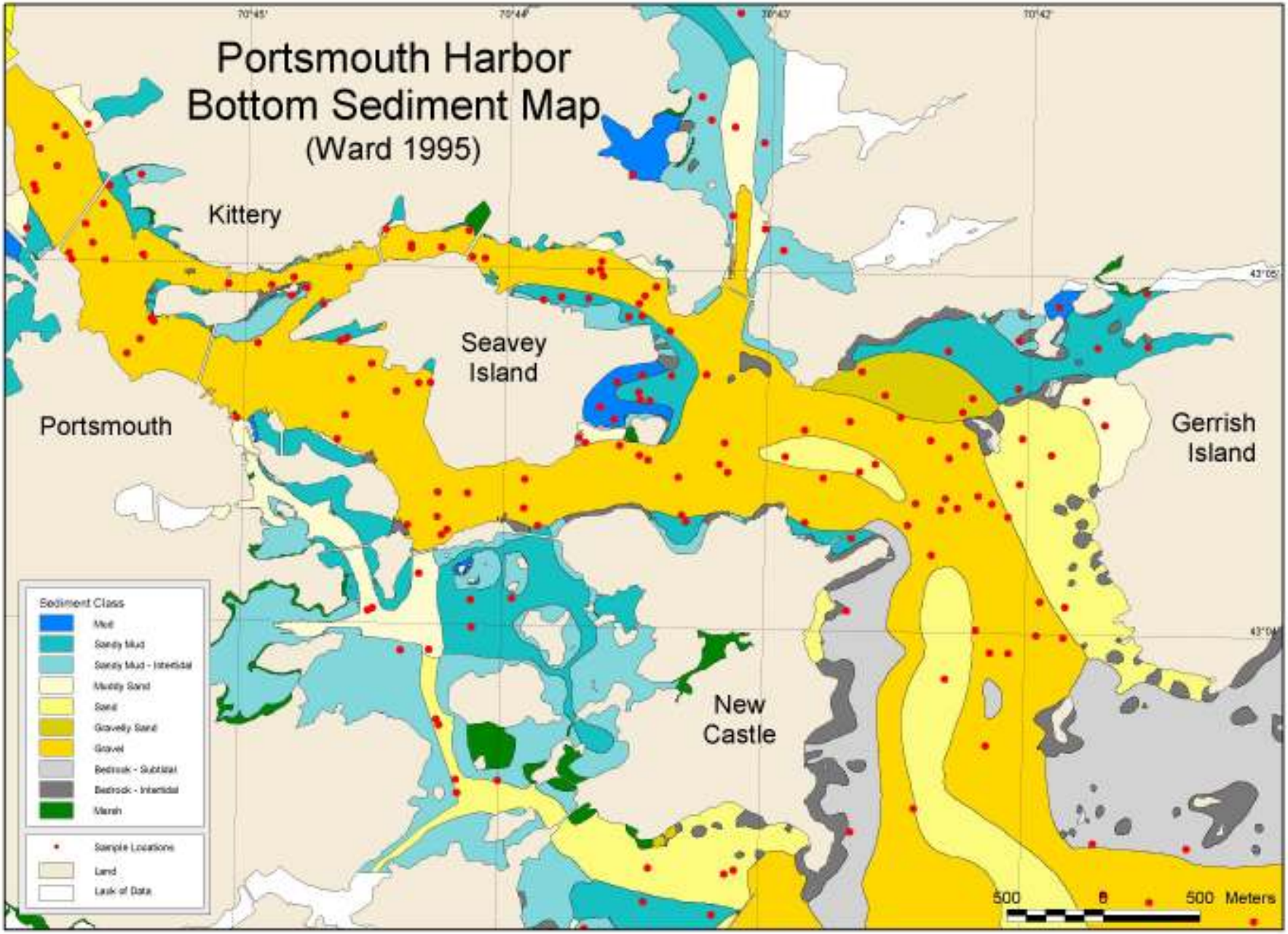
- *Dominated By Coarse-grained Sediment Deposits*
  - *Range from Gravel to Clays (Typical of Glaciated Systems)*
    - *Three end members dominate (-4 phi, 2 phi and 8 phi)*
  - *Source of These Sediments*
    - *Shelf?*
    - *Upper Estuary?*
- *Limited Fine-grained Surface Sediment Deposits*

Gravel Bottom
(Note Lasers for Scale)

Sandy Bottom
(with Bedforms/Sand Dollars)

Sandy Bottom
(with Organic Debris/Sand Dollars)

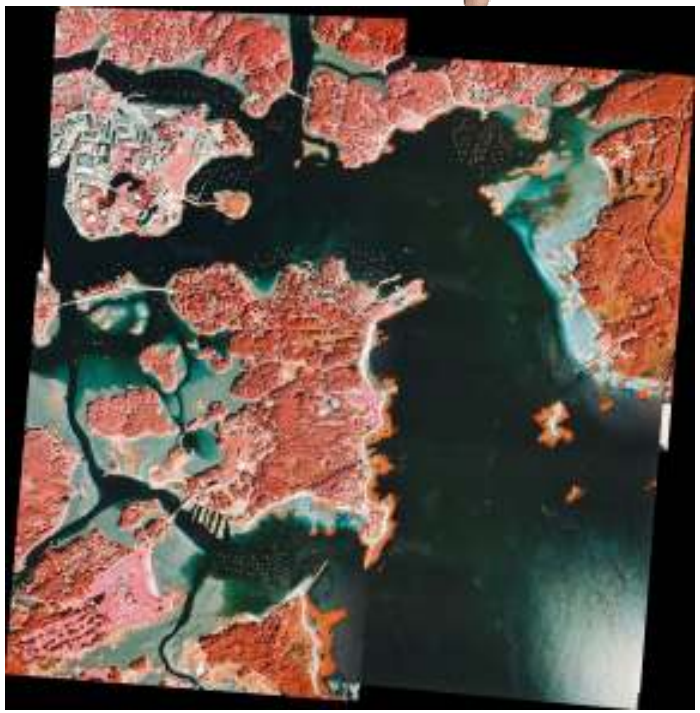
Bottom Sample


Portsmouth Harbor
Bottom Sediment Map
(Ward 1995)
Kittery
Seavey
Island
Portsmouth
Gerrish
Island
New
Castle
Sediment Class
Mud
Sandy Mud
Sandy Mud - Intertidal
Muddy Sand
Sand
Gravelly Sand
Gravel
Bedrock - Subtidal
Bedrock - Intertidal
Marsh
Sample Locations
Land
Lack of Data
500
0
500 Meters

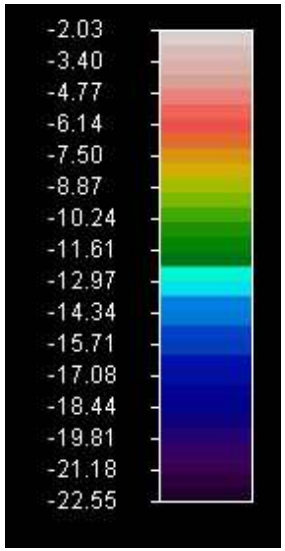
Lower Great Bay Estuary (Portsmouth Harbor)

Multibeam Bathymetry

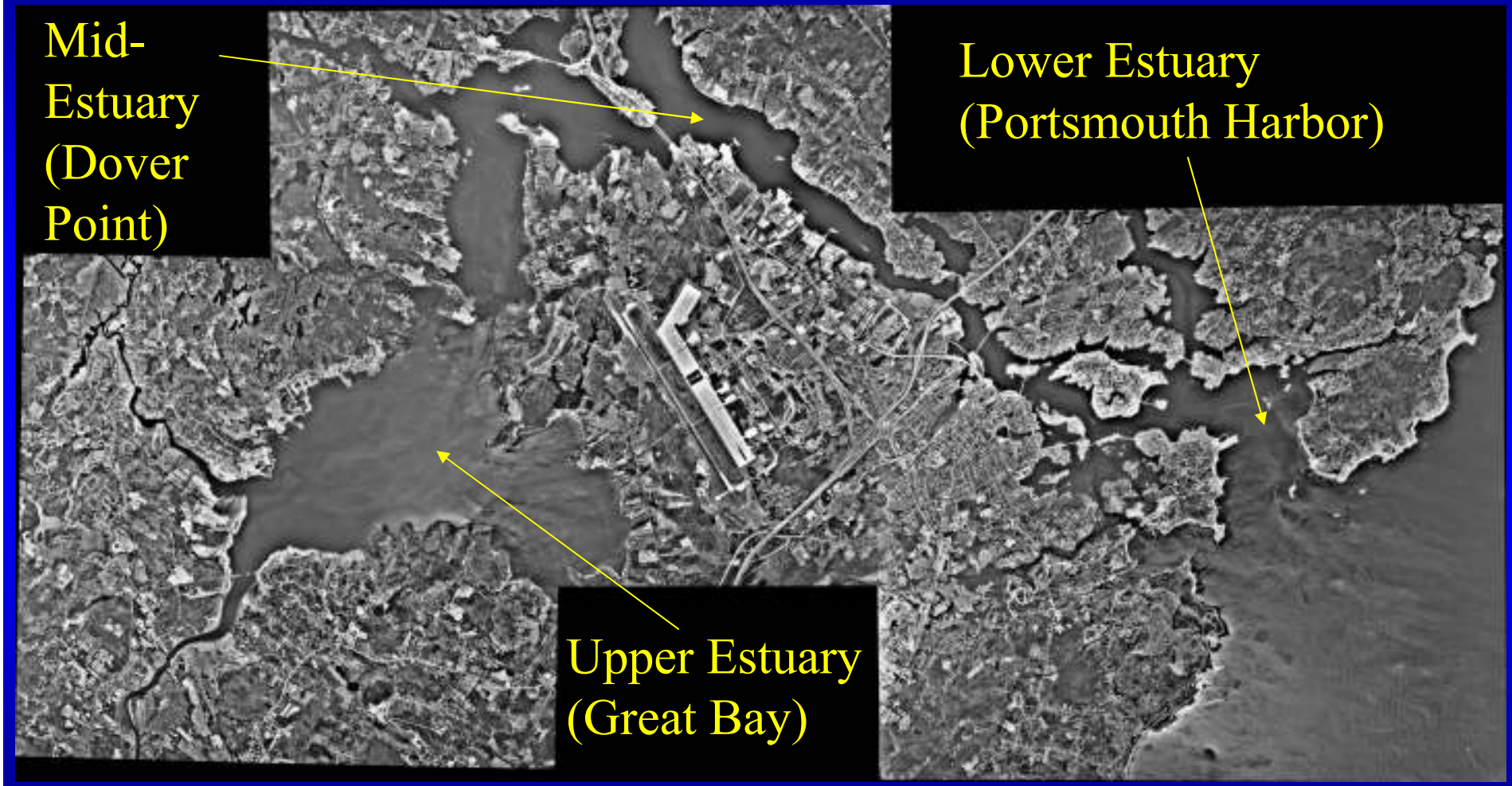
Sand Wave Fields



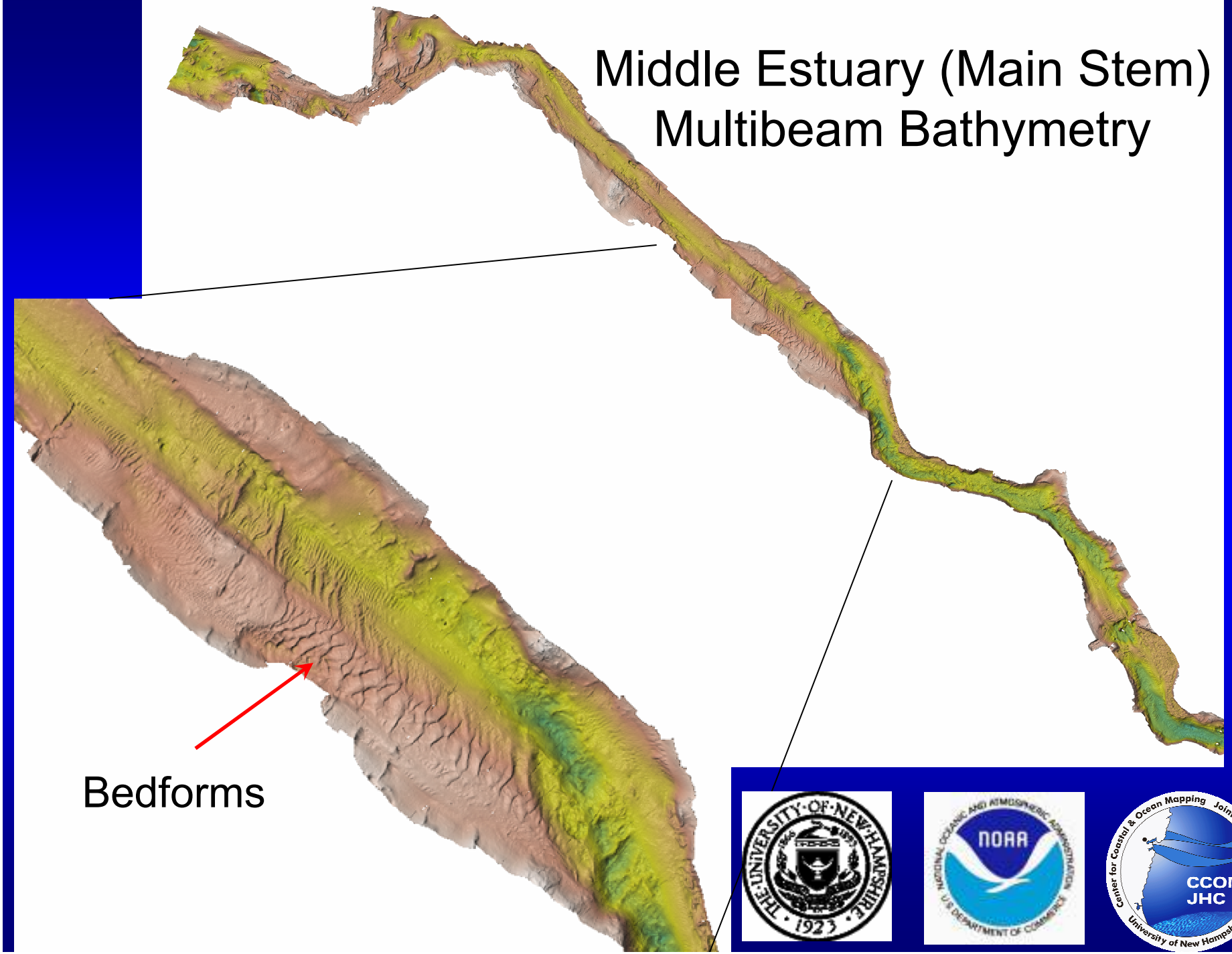
Depth (Meters)



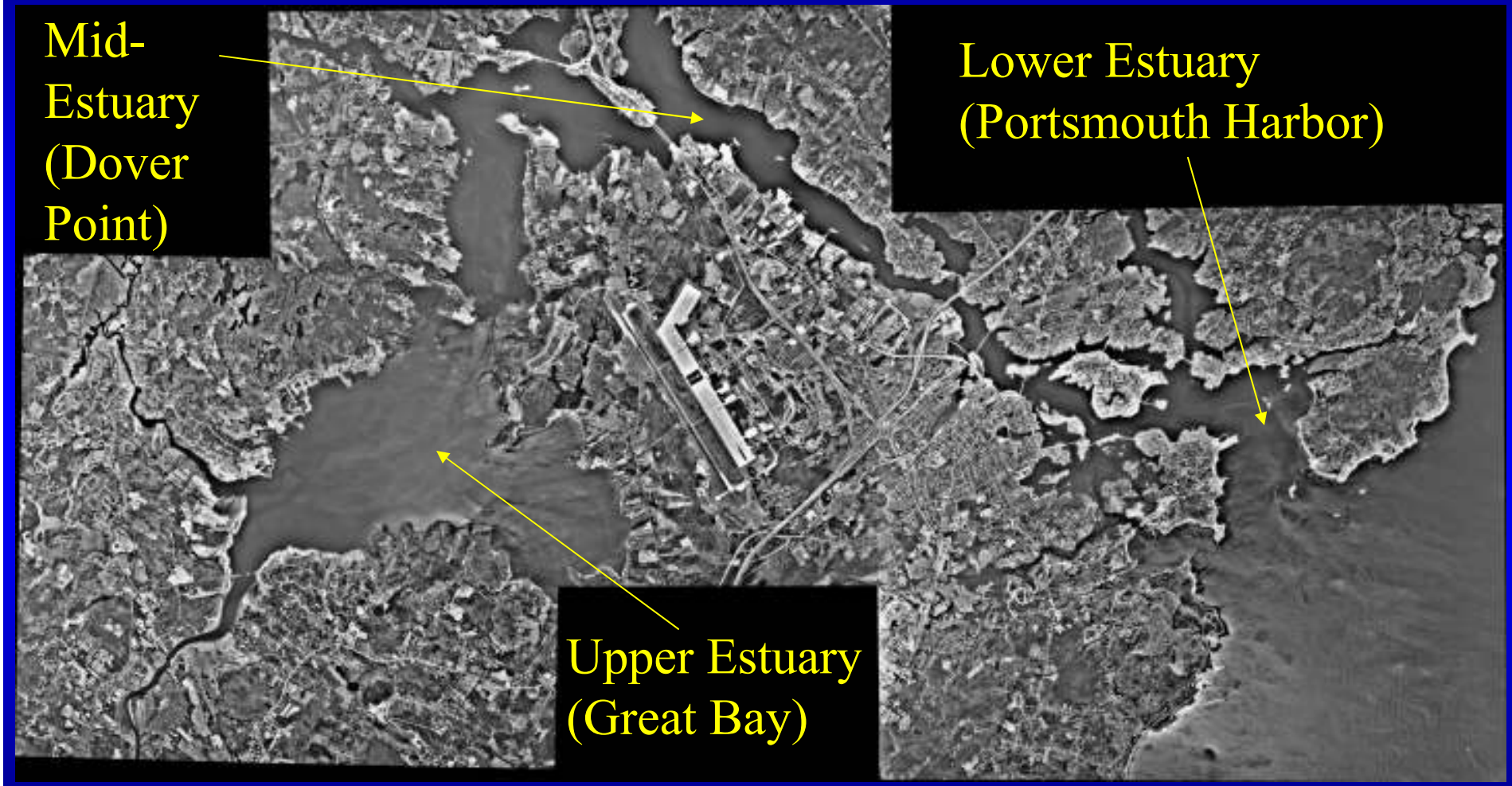
Characteristics of the Middle Great Bay Estuary
(Similar to Lower Estuary)



Middle Estuary (Main Stem) Multibeam Bathymetry



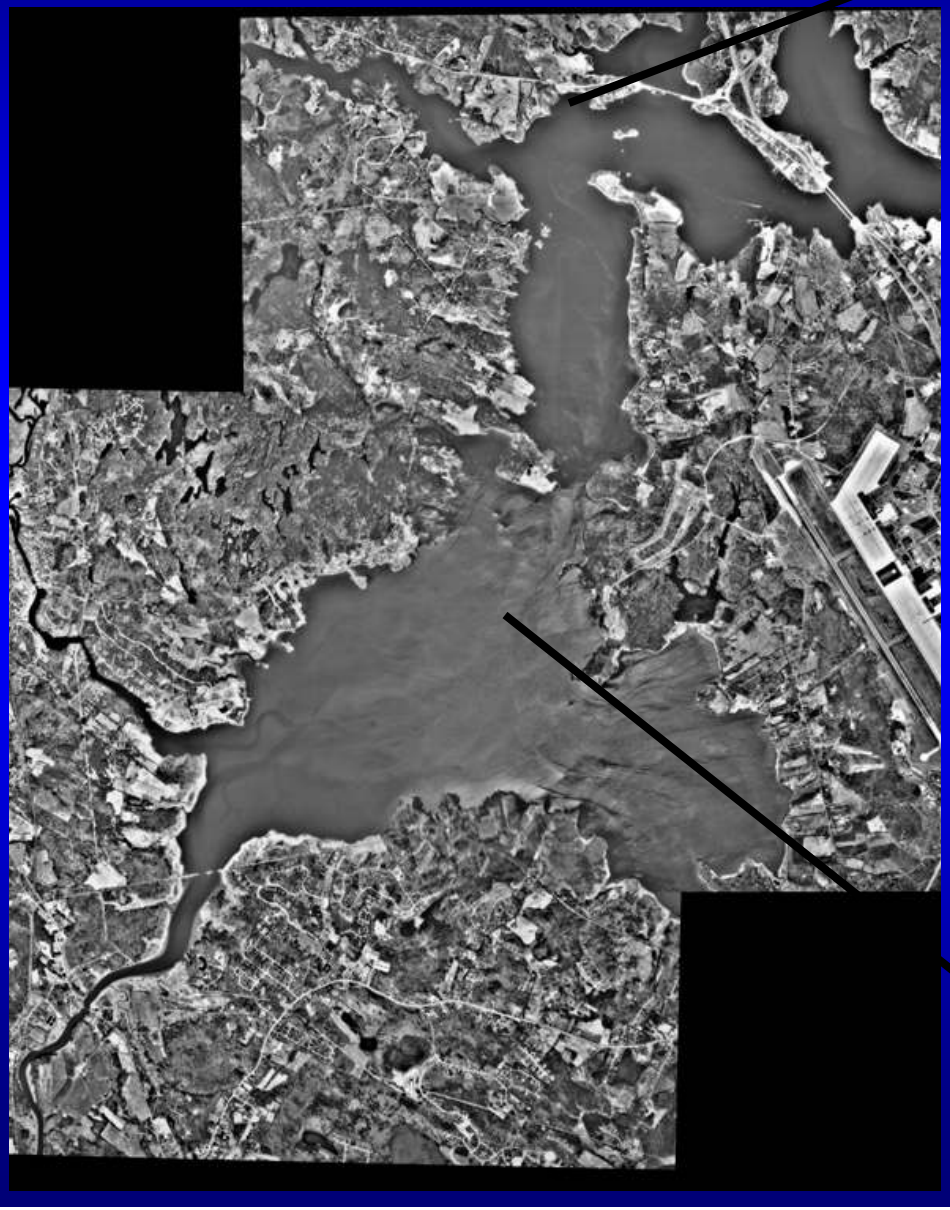
Characteristics of the Upper Great Bay Estuary

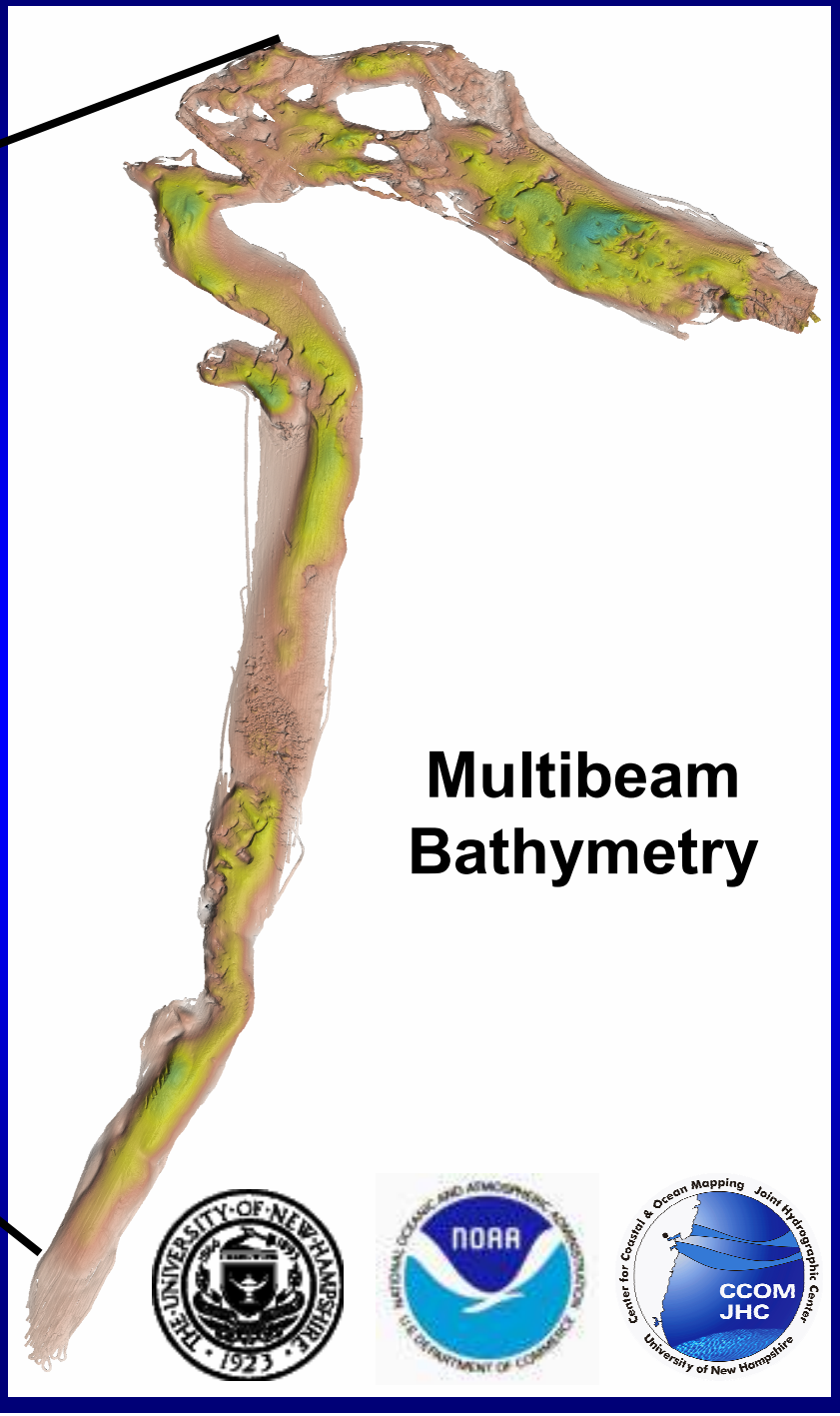


Upper Great Bay Estuary
(Little Bay, Great Bay, Bellamy, Tributaries)

- Bedrock Outcrops (Shoreline)
- Slightly Lower Gradients (More Accommodation Space)
- Strong Tidal Currents
- Moderate to High Sediment Supply
- Extensive Sediment Flats
- Subtidal Vegetation Important

Upper Great Bay Estuary (Little Bay and Great Bay)



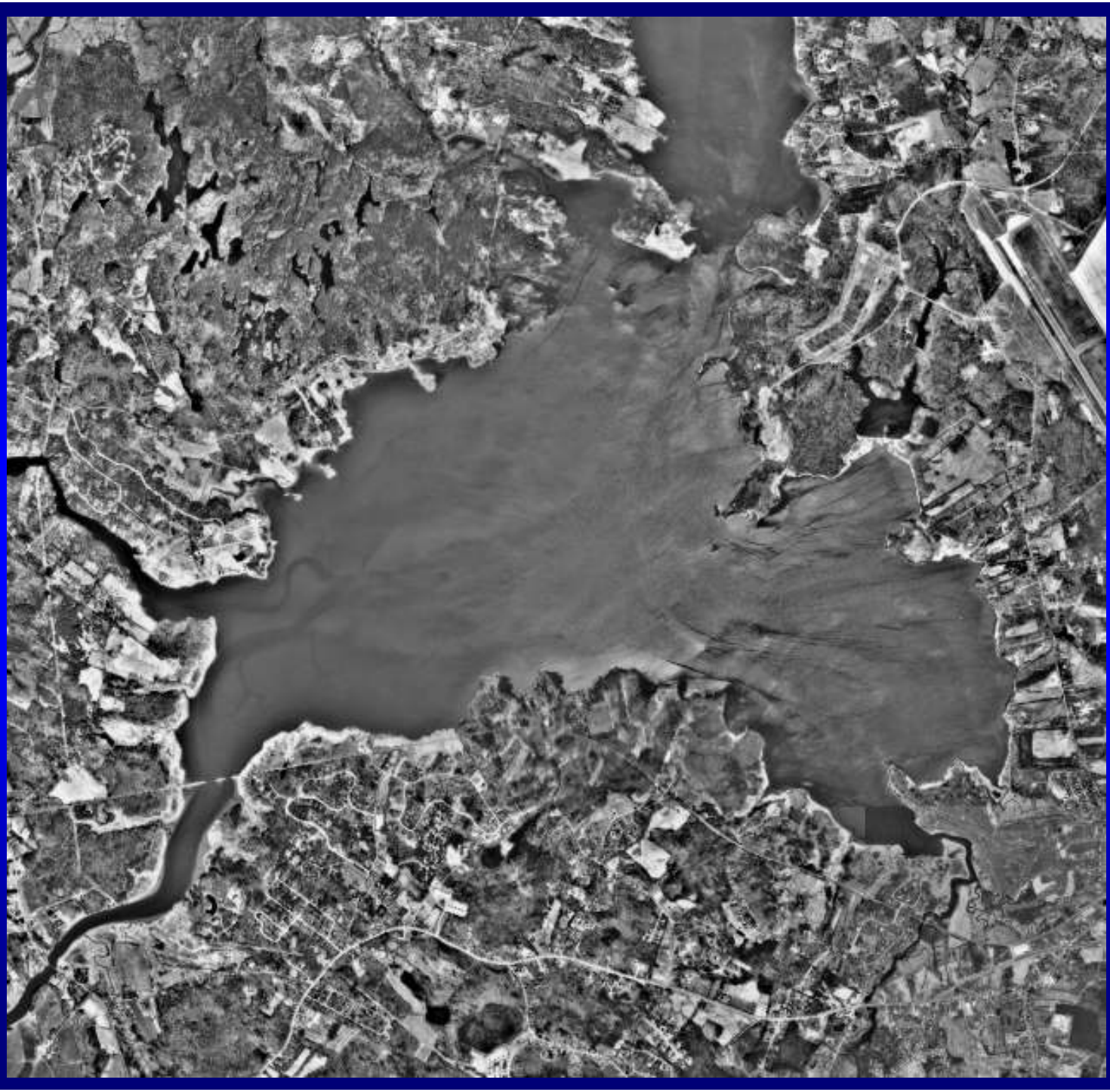


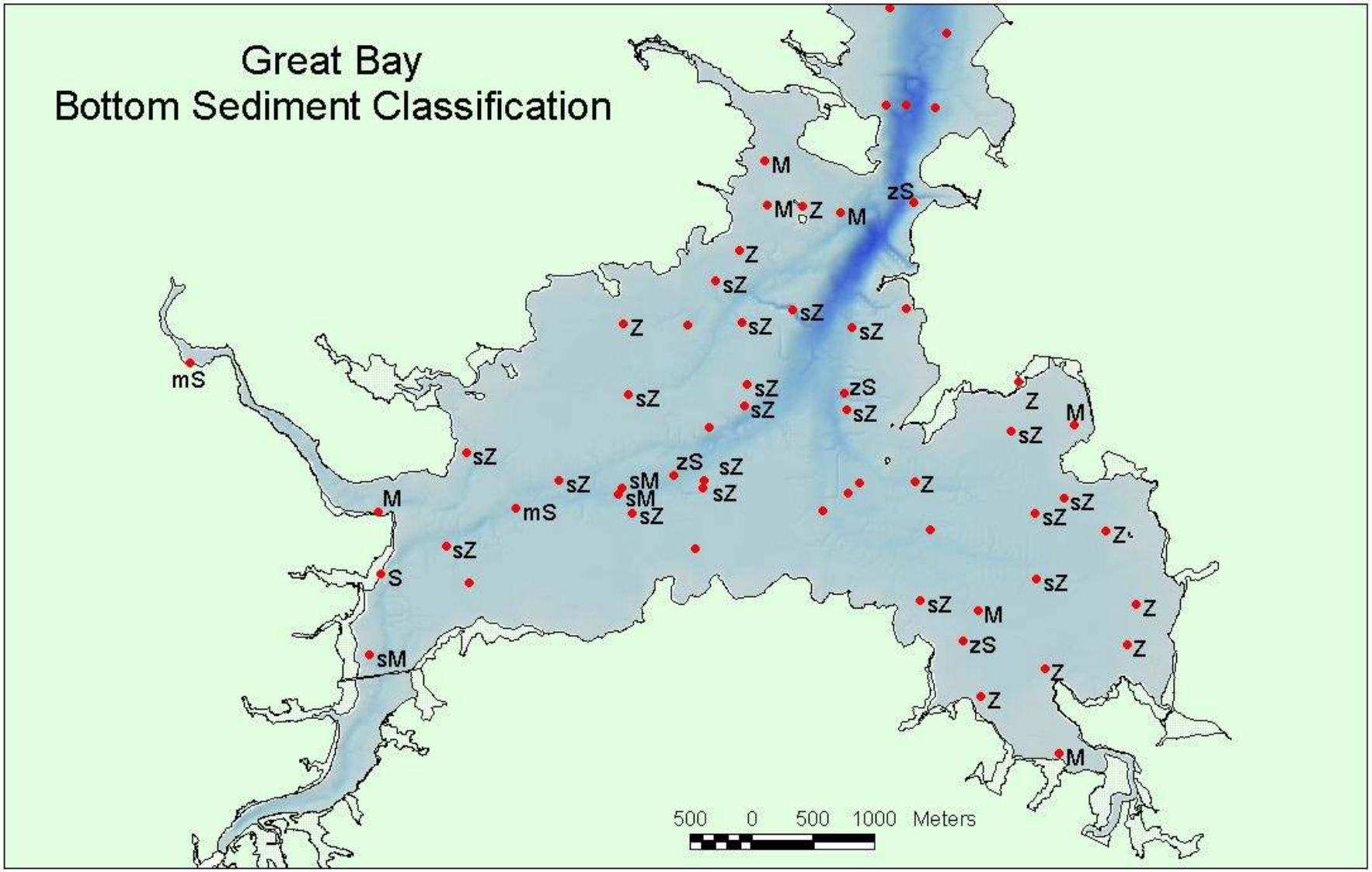
Multibeam Bathymetry

THE UNIVERSITY OF NEW HAMPSHIRE 1923

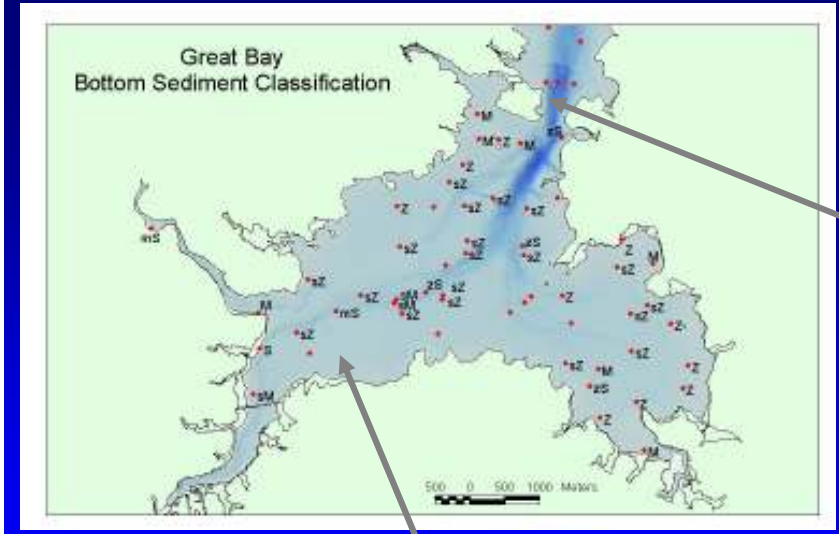
NOAA

Center for Coastal & Ocean Mapping Joint Hydrographic Center CCOM JHC University of New Hampshire




Great Bay
Bottom Sediment Classification
M
zS
M
Z
M
Z
sZ
sZ
Z
sZ
sZ
mS
sZ
sZ
zS
sZ
sZ
Z
M
sZ
sZ
zS
sZ
sM
sZ
M
sM
mS
sZ
sZ
Z
sZ
sZ
S
sZ
sZ
M
Z
zS
Z
Z
Z
M
500 0 500 1000 Meters

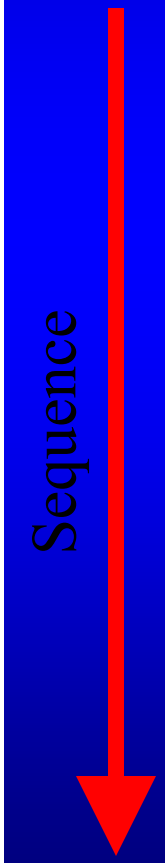

Submerged Vegetation



Mixing of Water Masses

Sediment Deposition and
Sediment Trapping

Tidal Flats in Upper Estuary are Major Source of Suspended Sediments to Estuary



- **Major Source of Suspended Sediments to GBE is Rivers**
- **Brought in During High Discharge Periods**
- **Deposited in Tidal Flats**
- **Resuspended by Wind Waves**
- **Mixed by Wind Waves and Tidal Currents**
- **Distributed to Middle and Lower Estuary by Tidal Currents**

Sources of Sediments to Estuaries

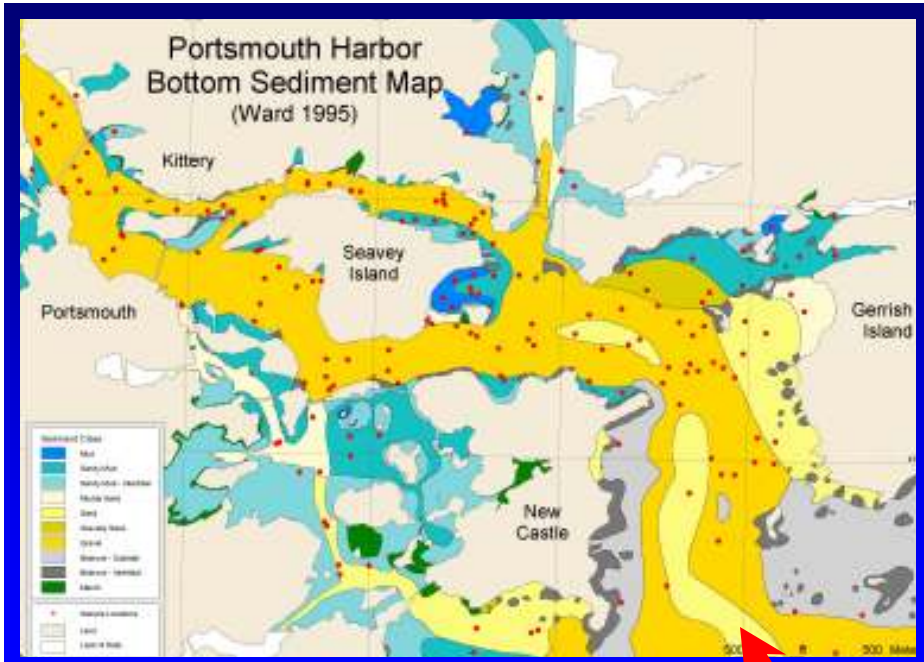
Riverine Inputs

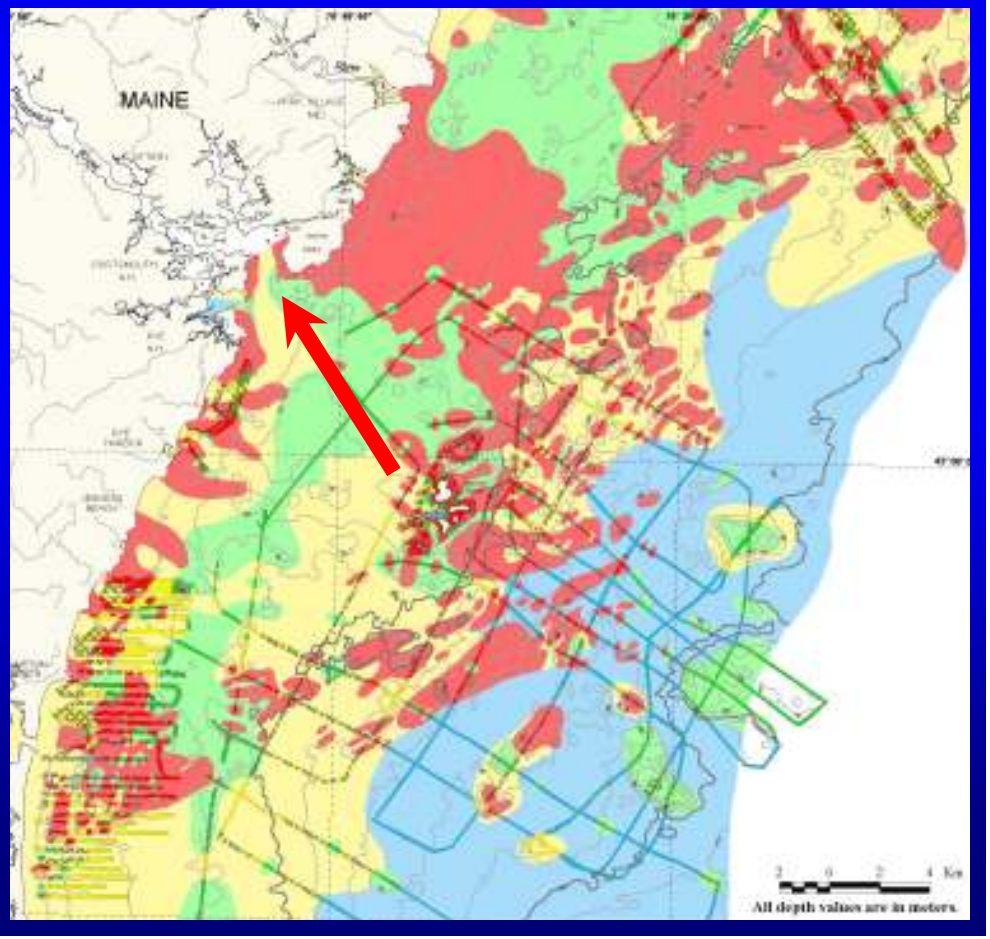
Marine Inputs

Shoreline Erosion

In Situ Productivity

Marine Inputs





Landward Transport of Coarse-grained Sediments from Shelf?

Some of the Factors Controlling Changes in Great Bay Estuary

- *Long Term Changes (Millennium)*
  - *Climate Change - Glaciations*
  - *Sea-Level Fluctuations*
- *Historical Changes (Centuries)*
  - *Climate Change*
  - *Anthropogenic Effects (Forest Clearing)*
- *Recent Changes (Decades)*
  - *Climate Change – Rapid?*
  - *Sea Level Rise – Rapid?*
  - *Anthropogenic Effects?*